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ABSTRACT

Since vision is the main source of perceptual information, this study attempted to assess the effect of motion information on the ability of ninety-two, first-grade children to analyze and depict spatial relationships. Three groups of children received either motion picture or stationary visual training to compare motion effects with methods more typical of the art classroom. A fourth group served as a control. Motion information yielded significantly superior results on both ability to analyze and depict space relationships as measured by perceptual differentiation tests and drawing tasks. According to some research studies motion is a primary source of visual information about the environment. In this study, improved visual perception may have resulted from analysis of objects depicted in motion situations, probably due to enhanced opportunities for examining spatial relationships. Since visual perception is a desired goal of the elementary curriculum in art and other areas, classroom teachers should give close attention to the possibilities of presenting visual stimuli in a moving context. (Author/MJB)

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30 Pages

MOTION INFORMATION EFFECTS ON CHILDREN'S PERCEPTION IN ART

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PROBLEM

Researchers in psychology and art education have recently attempted to explain the difficulties encountered in analyzing and graphically representing visually detected space. The main focus of efforts to this end has been on causal factors concerning the development of visual perception, to establish the means by which we obtain first-hand information from our environment. Interest has generally centered on aspects of maturation, art activities, and experiential factors involving practice with environmental stimulation.

Most studies of perception in psychology and art education have been concerned with analysis of data obtained from predominately static sources. This visual information, characteristically obtained through the use of stationary stimulus objects and observers, seems unrepresentative of the normal environment. An awake, active individual normally functions in dynamic surroundings where both the observer and observed often display the capability of motion.

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Purpose: Since vision is the primary source of percepts about objects and events in space, this investigation attempted to assess the effect of certain types of motion stimuli on the visual spatial abilities of young children. The purpose was to develop and evaluate a learning sequence involving motion information designed to increase the ability of the experimental subjects to graphically represent and analytically respond to visual space. The problem for analysis in this study was to determine if motion picture film treatments involving motion parallax could be utilized to affect the ambiguity in static perspective; thereby increasing information for the visual perceiving of objects and shapes as measured by perceptual test instruments.

RELATED LITERATURE

The distorted room[1] phenomena, where a static array distorts the gross physical layout of space in an ambiguous manner so that the abnormal room presents an illusory perception of a normal room, illustrates the usefullness of motion in space orientation. Here, motion on the part of the observer or the observed tends to provide increased perceptual information through transformation of the visual stimuli,

apparently eliminating the ambiguity in static perspective by disclosing additional spatial relationships.

The delineation of motion parallax as a factor in perceptual differentiation has developed from locomotion and orientation studies by J. Gibson[2,3,4] and E. Gibson and Walk.[5] Motion parallax is described by James Gibson as figural transformation in the visual field. As an object moves through the visual field it progressively covers and uncovers the physical objects and textures behind it, indicating depth at the edges of objects. In effect, changes in the optic array occur as an object or observer moves through space, specifying additional information about the geometric layout of the environment. While stimulus changes may occur in place or in time, the stimulus variables of ratio and proportion do not change. They remain invariant with movements and changes in intensity of stimulation. The basis for the motion parallax construct is that constant perception depends on the ability of the individual to detect invariants in the flux of changing sensations. Movement, in this case, seems to keep changing the input of sensation so as to isolate over time the invariants of the input for visual perception.

In psychology, and hence in art education, perceptual development has for some time been associated with biogenic or maturational factors.[6,7,8] While the difficulties encountered in children's representations of space indicated by these earlier studies are well established, more recent psychological studies indicate that children exhibit rudimentary awareness of depth/distance as early as eight months of age.[9]

Perceptual Studies in Art: Art education research in depth/distance discrimination has been in the area of methodology studies for the purpose of improving differentiation skills and drawing ability. In this vein, Kensler[10] studied the effect of direct perceptual training utilizing perspective drawing of stationary stimulus objects, and Rennels[11] used analytic and synthetic modes of perspective based on perceptual style in an attempt to affect change in disadvantaged Negro children's perception of space. While both significant and non-significant statistical findings were obtained with these older children, and each study encouraged subjects to move about in space, no attempt was made to assess possible effects of the motion variable.

Although art education studies by Efland,[12] Salome,[13] Silverman,[14] and others have directed

attention to evidence suggesting that perceptual training strategies hold relevance for certain art behaviors, few studies exist in art education which attempt to measure the ability of very young children to graphically and analytically respond to perceptual space. Further, studies designed to experimentally investigate the possibility of enhancing spatial abilities through the use of motion information seem nonexistent. Since studies of infants and animals in perceptual psychology indicate motion parallax as a primary means of spatial orientation, it was theorized that treatments involving motion parallax might serve as a means of increasing spatial perception in artistic tasks.

Perceptual Studies in Psychology: In human adults, change in stimulation dependent upon natural movements of the observer have been shown essential to the achievement of full and precise compensation for sensory rearrangements,[15] important for learning to function visually,[16] and a primary cue in the discrimination of depth and distance.[17] Binocular and monocular cues alone have been shown to be less effective in discrimination tasks.[18] In addition, Green found that impressions of depth and solidity could be obtained from films when successive frames showed lines and dots which differently related to the surfaces of three-dimensional rotating objects.[19]

Complete change of the outline was unnecessary, only some indication of the surfaces of an object in successive spatial positions was needed for the perception. Wallach and O'Connell projected shadows of solid objects on a translucent screen.[20] The shadow was judged to be that of a flat object as long as it remained motionless, but was perceived as a solid when it was rotated, with subjects frequently identifying its true shape. The implication of these studies is that motion offers information for perception and that filmed presentations of motion parallax appear to provide information sufficient for perceptual differentiation.

In psychology, the developmental data on differentiation has been primarily collected by Witkin,[21] characterized by attempts to increase analysis and structuring of visual/postural experience, and generally dependent upon indices utilizing a somewhat passive observer. Most of these tests tend to limit the capacity of the subject to seek information in the visual array. While finding limited success in training attempts utilizing drugs, sensory isolation and restraining devices, psychological research has demonstrated variations in differentiation apparently related to sex and developmental level,[22,23] the ability to reverse figure and ground,[24] and possible correlations with intellectual functioning.[25] Witkin's

studies suggest that perceptual styles are relatively stable and resistant to change through environmental and psychological means. Additional studies by Witkin,[26] Goldstein and Chance,[27] and Reeves,[28] however, tend to cast doubt on this issue by indicating that learning experience may alter the ability to analyze and segregate visual data.

Eleanor Gibson postulates that perceptual learning refers to an increase in ability to extract information from the environment as a result of experience and practice with stimulation coming from that environment. She theorizes that what is acquired in perceptual learning is an increase in specificity, described as detection of: (1) properties, (2) patterns, and (3) distinctive features in the environment. Since learned modification is in what is responded to, differentiation becomes stimulus oriented.[29] Perceptual learning is learning more than was learned previously from information that was always present.

Implications for Research: The foregoing studies gave impetus to the treatments utilized in this investigation, where subjects participated in viewing sessions using photographic stimuli as a means of distinguishing the distinctive features in the presented visual array. The key feature of the treatments, however, was absolute judgment practice concerning the spatial relations of pictorial objects in motion and stationary situations. To attain the materials and control

conditions necessary for this experiment, cartoon films[30] were selected which contained: (1) monocular clues to space,[31] (2) a variety of motion episodes, and (3) enhanced distinctive features.

This study made no attempt to assess or evaluate the aesthetic effects of motion perspective information. While Lansing[32] points out that art may find little virtue in imitating the spatial relations found in nature, Harris reminds that, "the total load of culture is to value such perceptions and the concepts based on them."[33] Lansing, too, concedes that the main purpose for the development of a child's concepts of space may be that such concepts give the artist more freedom in selecting visual forms to suit particular purposes. A principle issue of the present investigation was not whether young children should be taught to draw in perspective, but that they can be taught to see more clearly the existence of spatial relationships and the invariant information in the visual environment. This ability has relevance for any artistic endeavor.

The Hypotheses: This study was based on contrasts and comparisons of motion versus stationary visual training experiences relating to the graphic and analytic spatial abilities of first grade students. Relevant to the theory of motion information as a factor in

visual perceiving, and to examine causal relationships in the variables involved, the hypotheses stated that: (1) Perceptual experiences utilizing monocular clues in motion parallax situations would affect greater spatial differentiation in drawing tasks and embedded-figure-test performances for children than would identical but stationary stimuli training or non-training. Further, that (2) Stationary stimuli treatments, if otherwise identical to the motion parallax treatments, would affect greater differentiation in drawing task and embedded-figure-test performance than non-treatment would affect. Possible effects resulting from pre-test sensitization afforded the opportunity to also examine the hypothesis that: (3) Post-test performances on the drawing tasks and embedded-figure-tests would be greater for pre-tested motion parallax subjects than for subjects receiving the motion parallax treatment but no pre-testing. The accompanying null hypotheses were tested at the .05 level of confidence.

PROCEDURES

Sample: Four first grade classes from Oakdale Elementary School in Normal, Illinois, made up the experimental groups. Oakdale is a consolidated school with children from varying cultural, socio-economic, rural and urban backgrounds. The 92 subjects were comprised

of 45 boys and 47 girls with a mean age of six years and four months. The administrative staff assigned all students to classroom groups on an appearance basis and treatments were then assigned by use of random number tables. The subjects were assumed to be a random sampling of the corresponding population because of this administrative mixing and the method of assignment to treatment groups. F-maximum tests for homogeneity of independent variances conducted for age and Primary Mental Abilities test scores failed to disclose significant group differences, and homogeneity of variance was, therefore, assumed.

Time Period: Beginning on September 28, 1972, the duration of the investigation was eight school days, including two days of pre-testing and two days of post-testing. Contact sessions for testing and treatment purposes were limited to one hour per day for each group.

Treatment: The four groups were labeled Motion Group 1, Motion Group 2, Drawing Group 3, and Control Group 4. Group 1 and Group 2 had 24 and 25 subjects respectively, and received the motion parallax treatment. Group 3 was made up of 22 subjects receiving a stationary stimuli drawing treatment. Twenty-three subjects comprised Group 4 which was used as a control.

The methods of instruction and visual stimuli for Motion Treatment Group 1,Motion Treatment Group 2,and

Drawing Treatment Group 3 were identical, with the exception that Drawing Group subjects received visual stimuli in the form of color slides as opposed to motion picture film for the Motion Groups. This exception was made for control purposes in an effort to isolate the critical motion variable and to provide contrasts with a group receiving training more typical of classroom art techniques. Except for pre- and post-testing sessions, Control Group 4 received no contact from the investigator or art training throughout the duration of the treatment period. Due to the absence of the experimental variables, pre- and post-test scores for the Control Group were utilized for test-retest reliability estimates on the instruments used in the study. The students in all groups were accustomed to visitations from teaching specialists, testing, and visual equipment, and appeared unaware of the experimental nature of the treatment.

The Motion Treatment for Group 1 and 2 incorporated a four day series of one hour film viewing sessions with motion perspective information. Three separate "Roadrunner" cartoon films and a Bell-Howell film projector with stop and reverse capabilities were the major features of this treatment. After initial

instruction regarding the definition and discussions of monocular clues relating to space perception, the subjects actively participated in the following activities:

1. A preview of the 16 mm film.
2. Estimation and absolute judgment practice concerning relative space relationships of spatial objects via stop and reversal action of the film during which subjects were asked to judge infinity, maximum closeness, and halfway points in the moving array.
3. Identification of invariant monocular clues to perspective.
4. Opportunity for illustration and picture making.

Motion Treatment Group 2 differed in that this group received only a post-testing session rather than both pre- and post-test sessions.

The treatment for Drawing Group 3 was identical to the definition, analysis and production of monocular clues utilized in perspective drawing administered to the Motion Treatment Groups. However, colored slides of the same 16 mm film episodes used in the motion treatment were utilized for illustrative purposes with this group in an attempt to hold constant the stimulus information for all experimental treatments. The pictorial stimuli was, therefore, stationary. Stationary pictorial cues used in this manner are more common to traditional drawing instruction. After initial instruction regarding the definition and

discussion of monocular clues relating to space perception, the Drawing Group subjects actively participated in the following activities:

1. A preview of the 2 x 2 colored slides.
2. Estimation and absolute judgment practice concerning the relative space relationships of spatial objects in the slides during which subjects were asked to judge infinity, maximum closeness, and halfway points in the static visual array.
3. Identification of invariant monocular clues to perspective.
4. Opportunity for illustration and picture making.

Instrumentation and Reliability: Two evaluative instruments provided measurement of the experimental variables for this study. A group adaption of the Coates Preschool-Embedded-Figure-Test (PEFT) and a Drawing Task Test were used as pre- and post-test measures of spatial ability.

The Coates PEFT was used to examine the possibility that the experimental treatment might affect the ability to analyze and discriminate a figure from complex surroundings. The PEFT is a revision of the Children's-Embedded-Figures-Test (Karp and Konstadt, 1963) and is designed for use with younger children. Both the PEFT and the CEFT are based upon the Embedded-Figure-Test (EFT) developed by H. A. Witkin. Witkin contends that the EFT is a more reliable indicator of

differentiation as a determinant of perceptual style than the Body-Adjustment-Test (BAT) or the Rod-Frame-Test (RFT), the related indices of differentiation ability.

The Coates instrument contains three practice items and 24 test items. The subject's task for each item is to visually locate a constant stimulus standard which is a triangle shape hidden in a complex linear configuration. Correct identification within a 45 second time period is scored. Coates reports an odd-even reliability coefficient of .83 for the PEFT and a test-retest stability coefficient of .75 after five months for five-year-old subjects.

Since spatial representation is an important aspect of the graphic problems common to art education, and instruments for assessment of young children's abilities in this area are few, it was necessary to construct a Drawing Task Test capable of measuring the extent to which spatial devices are included in drawing. A numerical five criterion rating scale was developed for assessing experimental effects on graphic representation of space. Each criterion item described a single type of monocular clue that might be used in the graphic representation of space. These items were based on Anderson's explanation of monocular clues

to space perception and were defined as (1) relative size, (2) position, (3) overlap, (4) linear perspective, and (5) texture gradient. Drawings which included examples of these criteria were awarded numerical scores for each instance of monocular clue usage.

The stimulus task for the drawing test was an assigned topic to be completed upon 12 x 18 inch manilla drawing paper using 3B drawing pencils. Prior to each testing session, a five minute recording of the children's story, "Peter and the Wolf," was played as a motivational device. The topic for drawing was the statement, "Peter and his friends were walking along when suddenly, a WOLF appeared!" The subjects were then asked to illustrate how this scene might appear if it could be observed. This topic was selected because it seemed to provide opportunity for the use of spatial clues in drawing, yet did not offer obvious spatial relationships.

To establish the reliability of the instrument, three independent judges were given copies of the rating scale, a log listing procedures for applying the scale to drawings of the assigned topic, scoring sheets, and an intensive training session. This session resulted in inter-rater reliability estimates ranging from .81 to .91 for scores of practice drawings produced during the treatment period. Upon

completion of the rating for the entire sampling of test drawings, reliability estimates were computed for 69 pre-test drawings from groups 1, 3 and 4 and also for 69 post-test drawings from groups 1, 2, and 3. This analysis yielded correlation coefficients of .92 and .97 respectively. Test-retest reliability estimates using pre- and post-test drawing scores for Control Group 4 yielded a correlation coefficient of .79, indicating reasonable reliability for the drawing instrument and rating methods with these young subjects over the eight day treatment period.

RESULTS

Analysis of PEFT Data: An analysis of covariance for the hypothesis concerning improvement of children's ability to analyze and differentiate visual tasks was conducted using pre-test PEFT scores as the covariate for post-test PEFT scores, to determine if either of these variables was associated with significant group differences. The F-ratio and computer generated analysis of covariance data for comparisons of Motion Group 1, Drawing Group 3, and the Control are reported in Table 1.

TABLE 1

PEFT INSTRUMENT SUMMARY OF ANALYSIS OF COVARIANCE DATA FOR ADJUSTED POST-TEST SCORES FOR MOTION GROUP 1, DRAWING GROUP 3, AND CONTROL GROUP 4

Source of variation	Adjusted sum of squares	Degrees of freedom	Adjusted mean squares	F-ratio
Adjusted between	490.0242	2	245.0121	37.5290*
Adjusted within	424.3589	65	6.5286	
Adjusted total	914.3831	67		

*$p < .01$

The F-ratio of 37.5290 for PEFT score comparisons was significant at well beyond the .01 level of confidence, indicating differences in group performance as measured by the dependent variable. The F-ratio for homogeneity of regression in this instance was also significant at beyond the .05 level, indicating unequal regression coefficents. However, since analysis of covariance is robust and capable of tolerating slight discrepancies when n is equal, the F-ratio was considered to be within the limit of the statistic's capacities.

The analysis of covariance also generated pretest and adjusted post-test means. In this respect, Motion Group 1 displayed means of 12.8 and 20.3;

Drawing Group 3 yielded means of 12.2 and 14.7; and the Control Group displayed means of 12.0 and 14.6.

To isolate and examine the between group differences indicated by the analysis of covariance data, t-tests were conducted utilizing the adjusted post-test means. The results of the t-test analysis are presented in Table 2.

TABLE 2

t-TEST ANALYSIS OF ADJUSTED POST-TEST MEANS FOR COMPARISONS OF MOTION GROUP 1, DRAWING GROUP 3, AND CONTROL GROUP 4 ON PEFT PERFORMANCE

Source	Degrees of freedom	t	Significance level
Motion Group 1 and Drawing Group 3	44	7.3920	<.01
Motion Group 1 and Control Group 4	45	7.5445	<.01
Drawing Group 3 and Control Group 4	43	0.0795	N.S.

The difference between the post-test adjusted means from Motion Greatment Group 1 and Drawing Treatment Group 3 was significant beyond the .01 level of confidence, indicating that the Motion Group performed at a higher level of achievement as measured by the PEFT. The difference between the adjusted means from Motion Group 1 and the Control Group was also significant at beyond the .01 level, with an obtained t-value

of 7.5445. Comparison of PEFT scores for Drawing Group 3 and the Control Group yielded a t-value of 0.0795 which was not significant, therefore, the data was judged inconclusive and the null hypothesis was retained in this instance.

Motion Group 2 received a treatment identical to that of Motion Group 1 but was not pre-tested. To examine the possibility of pre-testing effects working in conjunction with the motion variable, an analysis of variance technique was used to compare the post-test PEFT scores of these two groups. The results of this testing are reported in Table 3.

TABLE 3

PEFT INSTRUMENT ANALYSIS OF VARIANCE SUMMARY FOR PRE-TESTING EFFECTS ON POST-TEST SCORES FOR MOTION GROUPS 1 AND 2

Source of variation	Sum of squares	Degrees of freedom	Mean squares	F-ratio
Group	3.539	1	3.539	0.6397 (N.S.)
Within	248.929	45	5.532	
Total	252.468	46		

The analysis of variance for comparison of post-test scores for the Motion Treatment groups yielded a

non-significant F-ratio. The data concerning pre-test sensitization effects on PEFT scores was, therefore, inconclusive and the null hypothesis was retained.

Analysis of Drawing Instrument Data: Analysis of covariance techniques were also used to analyze data concerning the ability of children to graphically represent the spatial relationship of objects. Drawing Task Test scores assigned by the three independent judges were averaged for both pre- and post-test drawings, producing a single scores for each first grade subject on each test performance. The F-ratio and data for this analysis, again using pre-test scores as the covariate and post-test scores as the variate, is reported in Table 4.

TABLE 4

DRAWING INSTRUMENT SUMMARY OF ANALYSIS OF COVARIANCE DATA FOR ADJUSTED POST-TEST SCORES FOR MOTION GROUP 1, DRAWING GROUP 3 AND CONTROL GROUP 4

Source of variation	Adjusted sum of squares	Degrees of freedom	Adjusted mean squares	F-ratio
Adjusted between	2777.3823	2	1388.6913	79.5291*
Adjusted within	1134.9917	65	17.4614	
Total	3912.3740	67		

*$p < .01$

The F-ratio of 79 5291 generated by this analysis was also significant at beyond the .01 level of confidence, suggesting improvement in group performance as measured by the Drawing Task instrument. The F-ratio for homogeneity of regression for this analysis was 0.8455, which is not significant. Regression coefficients were assumed equal in this case, and homogeneity of regression was, therefore, assumed for analysis of covariance purposes.

The analysis of covariance statistic generated both pre-test and adjusted post-test means for drawing comparisons. In this respect, means of 2.70 and 17.06 were yielded for Motion Group 1; Drawing Group 3 indicated means of 5.04 and 4.32; and the Control Group displayed means of 3.78 and 2.31.

The group mean differences in drawing performance for analysis of covariance computations were further scrutinized by t-test statistics to determine between which groups the differences were obtained. The results of this analysis are presented in Table 5.

TABLE 5

t-TEST ANALYSIS OF ADJUSTED POST-TEST MEANS FOR COMPARISONS OF MOTION GROUP 1, DRAWING GROUP 3, AND CONTROL GROUP 4 ON DRAWING TASK SCORES

Source	Degrees of freedom	t	Significance levels
Motion Group 1 and Drawing Group 3	44	9.6339	< .01
Motion Group 1 and Control Group 4	45	11.9053	< .01
Drawing Group 3 and Control Group 4	53	1.5748	N.S.

The difference between the adjusted means of Motion Treatment Group 1 and Drawing Group 3 in graphic ability to represent space was significant beyond the .01 level of confidence with a $t = 9.6339$. The difference between Motion Group 1 and Control Group 4 on this variable was also significant at beyond the .01 level of confidence, again indicating greater gains for the motion treatment as contrasted to the stationary stimulus drawing treatment or the non-treatment control. The adjusted post-test mean difference between Drawing Group 3 and Control Group 4 did not reach the .05 alpha level and was not significant. The null hypothesis was retained in the latter instance since the data proved inconclusive.

Analysis of variance procedures, utilized in this instance as in the PEFT analysis, were conducted to

assess the effects of pre-testing against no pre-testing for the drawing task by utilizing post-test scores for each of the two Motion Treatment groups. The results of this statistical procedure, making use of Motion Group 2 which received no pre-testing experience for the experimental drawing task, are reported in Table 6.

TABLE 6

DRAWING INSTRUMENT ANALYSIS OF VARIANCE SUMMARY FOR PRE-TESTING EFFECTS ON POST-TEST SCORES FOR MOTION GROUP 1 AND 2

Source of variance	Sum of squares	Degrees of freedom	Mean squares	F-ratio
Group	1.277	1	1.277	0.02402 (N.S.)
Within	2391.659	45	53.148	
Total	2392.936	46		

An F-ratio of 0.02402 yielded by this hypothesis testing did not reach the .05 level of confidence. The results were, therefore, judged inconclusive and the null hypothesis of no significant difference was retained.

CONCLUSIONS AND DISCUSSION

Conclusions: Based on analysis of covariance data obtained from this study, and pending further research, the following conclusions are inferred:

1. Supported by evidence of increased PEFT performance as a measure of increased perceptual differentiation, this study concludes that motion parallax was of definite benefit to the children in this sample as a means of clarifying and sharpening the ability to visually analyze perceived space.

2. This conclusion is also supported by evidence that these subjects' ability to represent, and thus communicate, awareness of spatial relationships in drawings was strongly and positively affected by the motion variable.

3. No evidence supporting the presence of pretest sensitization effects was discovered.

Discussion: Two different instructional methods were used in this study, one presenting stationary visual stimuli and the other presenting the same stimuli in a motion context. Data comparisons of the motion treatment, drawing treatment, and control groups indicated improved graphic and analytic spatial ability favoring only the motion treatment, suggesting that the stationary information was ineffective in altering differential ability as measured by the dependent variables.

The findings of this study tend to be consistent with research which suggests that motion parallax is the primary source of depth/distance information for young children, and that without motion information, learning may be severely deprived. The findings of this experimental investigation are inconsistent, however, with some psychological and descriptive art research which suggests developmental stages of spatial ability corresponding to chronological age or inherent maturational growth. Age did not appear to be a factor in this instance, as the motion subjects were able to alter their performance levels following only a short duration treatment.

The results of the motion treatment may be attributed to several related operational factors. The treatments were simple in content, calling mainly for absolute judgments concerning spatial orientation of objects at maximum closeness, infinity, and halfway points in the presented visual array. The five monocular clues used to introduce the concept of pictorial depth and distance appeared, for the most part, to serve as reinforcement for spatial concepts already at hand. Nearly all of the subjects were readily able to respond to the verbal instructions for visual practice tasks. The motion treatments were presented in a familiar, yet

interesting context; that of motion picture cartoons. Interest and response appeared high during the treatment periods and practice drawing sessions for monocular clue usage by both the motion and stationary stimuli groups. Treatment presentations were ordered from the simple to the complex, and reinforcement was immediately at hand when judgments were made, as verbal and physical responses by the subjects supplemented the visual analysis of the film.

Most importantly, exposure to motion parallax information via motion pictures made possible the presentation of intense and varying visual data in a short period of time, with assurance that most subjects viewed exactly the same stimuli. While the drawing group viewed slides of each visual episode from the films and received identical instruction, this flexibility, control, and variation of the visual stimuli within the same time span was not possible. For this reason, interest arousal may be greater with motion than with stationary stimuli and hence influence visual analysis. If this is true, however, the argument would seem a reinforcement rather than a deficit for the use of motion in an educational setting.

Beyond the usual recommendations of replicating the study and achieving better control of the crucial

variables, at least three additional directions seem worthy of consideration:

1. Investigation of motion parallax effects upon the production of three-dimensional works of art.

2. Comparative assessment of the effects of three-dimensional motion stimuli under control conditions with the pictorial approach utilized in the present research.

3. Replication of the study with varied age groups and examiners.

In addition to these recommendations, it was of interest to note that while comparisons of post-test only Motion Group 2 with the drawing and control groups were not hypothesized, they were analyzed. In each instance the second motion group was significantly superior in performance. Of particular interest for the observers was the obvious increase in complexity and detail apparent in the post-test Motion Treatment Group drawings. Their appearance in this regard was comparable to the work of children several years older. This aspect of the study also bears investigation, perhaps with an aesthetic orientation and instrumentation.

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